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Evaluation of Genetic Parameters in M_4 Generation of Soybean Mutant Lines

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A B S T R A C T

Mutation breeding is an effective approach in improvement of crop having narrow genetic base such as soybean by creating variability. Studies on variability, heritability and genetic advance on yield and yield contributing characters are the pre – requisites for selection of parents. Hence, 283 M_4 mutants along with their parents *viz*., Co (Soy) 3 and JS 335 were raised in Randomized Block Design (RBD) with two replications at Department of Pulses, Centre for Plant Breeding and Genetics, TNAU, Coimbatore, during *Kharif* 2013. In the present investigation, high PCV and GCV coupled with high heritability was observed in plant height, number of clusters per plant, number of pods per plant, seed yield per plant and phytic acid content. This indicates the lesser influence of environment in expression of these characters and prevalence of additive gene action in their inheritance. Hence, these traits are amenable for simple selection.

Introduction

Soybean [*Glycine max* (L.) Merrill], with its countless and varied uses, is an important crop at the global level. Soybean is the world's foremost provider of protein and oil. It is referred to "the protein hope of the future" as well as "the miracle golden bean" because of its high nutritive value as it is a good source of unsaturated fatty acids, minerals like Calcium and Phosphorus including vitamin A, B, C and D thus, it can meet up various nutritional needs. Being an important source of raw materials for various industries, soybean plays a very important role in changing the scenario of industrial sector. Hence, development of high yielding varieties specific to particular eco-geographic situation is of paramount importance. Choice of parents is the primary criterion for developing high yielding varieties or hybrids through any breeding programme. Studies on variability for yield and its related characters are the pre – requisites for choice of parents. Since the variability is highly influenced by the environment, it does not give a real picture of the potential genotypic variability. Hence, knowledge about heritability and genetic advance on yield and yield contributing characters are necessary for the crop improvement through selection. The present investigation was therefore planned to

estimate and evaluate different genetic parameters in 283 mutants for 11 characters.

Materials and Methods

The promising soybean varieties namely Co (Soy) 3 and JS 335 constitute the biological material for this study. These parental materials were subjected to mutagenic treatment utilizing Gamma and EMS. In M_3, 283 mutants were selected for various yield contributing traits. These 283 mutants were raised as M_4 generation to estimate yield and yield related traits along with low phytic acid content. These 283 mutants along with their parents were raised in Randomized Block Design (RBD) with two replications in four meter row with spacing of 30 × 10 cm, at Department of Pulses, Centre for Plant Breeding and Genetics, TNAU, Coimbatore, during *Kharif* 2013. Recommended cultural practices were adopted to raise good crop.

Five plants in parents and mutant lines were randomly selected in each replication and observations were recorded for days to 50 per cent flowering, days to maturity, plant height (cm), number of branches per plant, number of clusters per plant, number of pods per plant, number of seeds per pod, 100-seed weight (g), seed yield per plant (g), harvest index (%) and phytic acid content (mg/g).

The mean values of five plants were utilized for estimation of various genetic parameters like Phenotypic Coefficient of Variance (PCV), Genotypic Coefficient of Variance (GCV), heritability and genetic advance as per cent mean were calculated by adopting the formulae given by Johnson *et al.*, (1955).

Results and Discussion

Estimates of variability parameters in M_4 generation for 11 characters are presented in Table 1. The estimates of genotypic and phenotypic coefficient of variation are necessary to understand the role of environmental influence on different traits. The differences between the GCV and PCV values indicated the level of environmental variations that contribute a major part in the expression of traits (Majumdhar *et al.*, 1974).

Phenotypic and genotypic coefficient of variation

In the present investigation, the mutants exhibited considerable amount of variability for all the 11 traits studied.

The estimates of genotypic coefficient of variation were lesser than the estimates of phenotypic coefficient of variation indicating the environmental influence over the characters studied.

The characters plant height, number of clusters per plant, number of pods per plant, seed yield per plant and phytic acid content showed higher values of PCV and GCV.

Similar findings were reported by Narmadha (2013) and Amrita *et al.*, (2014). The results indicate a greater scope for selection to improve these characters.

Moderate values of PCV and GCV were noticed for characters *viz*., days to 50 per cent flowering, number of branches per plant, hundred seed weight and harvest index. Similar findings were reported by Hanafiah *et al.*, (2010) and Sridevi and Mullainathan (2012). This indicates selection for such traits may be rewarding.

The characters *viz*., days to maturity and number of seeds per pod showed lower values of PCV and GCV. Similar results were reported by Dhanavel *et al.*, (2012) and Mullainathan *et al.*, (2013). This indicates selection for such traits may be undesirable.

Table.1 Estimates of variability parameters in M_4 generation

Character	Mean	SE	Minimum	Maximum	PCV (%)	GCV (%)	Heritability (BS) (%)	GAM (%)
Days to 50 per cent flowering	31.24	0.24	27.00	41.00	13.06	12.34	89.19	24.00
Days to maturity	80.43	0.33	75.00	91.00	6.81	6.40	88.49	12.41
Plant height (cm)	33.87	0.75	11.00	74.00	37.14	36.11	94.55	72.34
Number of branches per plant	5.54	0.08	2.80	10.20	23.09	13.49	34.13	16.23
Number of clusters per plant	20.62	0.56	3.60	56.80	45.85	43.27	89.07	84.13
Number of pods per plant	67.51	1.80	13.40	182.64	44.74	43.03	92.50	85.26
Number of seeds per pod	2.35	0.01	2.00	2.60	8.24	7.06	73.41	12.47
Hundred seed weight (g)	11.34	0.12	3.94	15.80	17.29	16.15	87.22	31.07
Seed yield per plant (g)	19.58	0.57	3.40	53.84	49.33	44.20	80.25	81.56
Harvest index	0.59	0.54	0.18	0.75	15.60	12.98	69.27	22.26
Phytic acid content (mg/g)	4.84	0.09	1.76	9.10	29.99	29.34	95.72	59.14

Heritability and genetic advance as per cent of mean

The coefficient of variation indicates only the extent of variability existing for various characters, but does not give any information regarding heritable proportion of it. Hence, amount of heritability permits greater effectiveness of selection by separating out the environmental influence from the total variability and indicates the accuracy with which a genotype can be identified phenotypically. In the present study, broad sense heritability, which includes both additive and non-additive gene effects (Hanson *et al.,* 1956), was estimated.

The results indicated that estimates of heritability were high for all the characters except for number of branches per plant under study similar observations were made by Burli *et al.,* (2010) and Sujata *et al.,* (2011).

Yield being a complex character is influenced by many factors. In the present study, high heritability coupled with high genetic advance as per cent of mean was observed for days to 50 per cent flowering, plant height, number of clusters per plant, number of pods per plant, hundred seed weight, seed yield per plant, harvest index and phytic acid content. Similar results were reported by Khan *et al.,* (2007) and Anbuselvam *et al.,* (2010). This indicates the lesser influence of environment in expression of these characters and prevalence of additive gene action in their inheritance. Hence, these traits are amenable for simple selection.

High heritability accompanied with moderate genetic advance as per cent of mean was recorded for days to maturity and number of seeds per pod. The results indicate that these characters were governed by additive gene action and selection for such traits may be rewarding. Similar results were obtained by Sharma *et al.,* (2007) and Khan and Tyagi (2010).

From the above discussions, it can be concluded that high genotypic coefficient of variability and phenotypic coefficient of variability coupled with high heritability were observed for plant height, number of clusters per plant, number of pods per plant, seed yield per plant and phytic acid content. This indicates that there is a lesser influence of environment in the expression of character which is amenable for selection. The character viz., days to 50 per cent flowering, number of branches per plant, hundred seed weight and harvest index showed high heritability but moderate level of variability. Hence, these characters are also amenable for selection by minimizing the environment influence. The character viz., days to maturity and number of seeds per pod showed high heritability but low level of variability. Hence, these characters are not amenable for selection.

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